

## STS-109 Flight Readiness Review (FRR) Minutes

The STS-109 FRR convened at 10:00 a.m. on Thursday, February 14, 2002 in the Mission Briefing Room at the Kennedy Space Center (KSC). The meeting was chaired by F. Gregory, Acting Associate Administrator, Office of Space Flight.

Flight Crew, Ferry Readiness, Range, and DDMS did not have any issues or constraints to flight and did not make formal presentations. Readiness statements submitted were included in the backup package.

The STS-109 FRR presenters were:

Mission Operations - W. Hale (NASA/JSC/DA8)

B. Austin (NASA/JSC/DA8)

T. Sobchak (NASA/GSFC/451.0)

L. Bourgeois (USA/Houston/USH-402L)

EVA - C. Seaman (NASA/JSC/XA)

Space and Life Sciences - C. Fischer (NASA/JSC/SD)

Program Integration - P. Engelauf (NASA/JSC/MA2)

P. Burch (NASA/GSFC/440.0)

Payload Processing - S. Higgenbotham (NASA/KSC/UB-1)

External Tank - R. Wetmore (LMSSC/MAF/3000)

RSRM - T. Boardman (Thiokol/Utah/L00)

SRB - S. Gordon (USA/KSC/USK-800)

R. Wright (USA/KSC/USK-840)

SSME - D. Adamski (Rocketdyne/Canoga Park/055-AC82)

Vehicle Engineering - D. White (USA/Houston/USH-601M)

P. Thornton (USA/Houston/USH-632L)

Shuttle Processing - J. Vevera (USA/KSC/USK-229)

G. Crews (USA/KSC/USK-459)

M. Leinbach (NASA/KSC/PH)

SR&QA - M. Erminger (NASA/JSC/MQ)

### Mission Operations

The mission summary consisted of the Shuttle overview, Cargo Bay Layout, the Mission and Extravehicular Activity (EVA) overviews. Networks reported two space network supported launches are scheduled around the same timeframe as STS-109 - the AtlasIII/ECHOSTARVII on February 21, 2002 and the Atlas II/TDRS-I on March 8, 2002. The facilities and certification of flight readiness were also presented. Mission Operations is ready to support the launch of STS-109.

### EVA

The Hubble Space Telescope (HST) Servicing Mission (SM) -3B has five scheduled EVA's, one unscheduled EVA and two contingency EVA's. The EVA challenges and timeline threats were presented. The EVA Training, Hardware and Tools summaries and the Extravehicular Mobility Unit processing were also presented. The EVA Project Office certifies that there are no constraints to the launch of STS-109.

### Space and Life Sciences

The crew's health was presented. There are three Detailed Supplementary Objectives (DSO's) on orbit and four DSO's pre/postflight scheduled for this mission. All the remaining open work is planned and scheduled. The radiation analysis and dosimetry

support along with the space weather activity summary and forecast were also presented. Space and Life Sciences Directorate is ready to support Flight STS-109.

#### Program Integration

STS-109 is the first flight of Columbia (OV-102) after its Orbiter Maintenance Down Period (OMDP). During the OMDP, the Multifunction Electronic Display System and the Wireless Video System were installed on OV-102. All the HST hardware is at Kennedy Space Center and ready to fly with the exception of the Reaction Wheel Assembly (RWA). The RWA will be installed in the Large Orbital Replacement Unit Protective Enclosure at Pad A on February 16, 2002. The HST flight hardware status, ground system and flight software summary, and open work were presented. There were four non-compliance reports, two deviations, and two waivers approved for this flight. The first deviation was the pistol-grip tool being one fault tolerant due to its original design. The second deviation was some HST hardware not meeting EVA requirements related to impact or temperature extremes. Waivers were presented on the HST payload complement not clearing the payload bay doors in the event of rapid safing situation and the EVA crew demating/mating of electrical connectors not meeting isolation requirements. Also presented was the HST SM-3B External Independent Readiness Review Report. Space Shuttle Integration is ready for flight pending completion of the defined open work.

#### Payload Processing

One special topic was presented on the RWA removal and replacement. The processing milestones, launch delay requirements and engineering status were presented. Pending successful completion of the remaining scheduled Pad operations the KSC International Space Station/Payloads Processing Directorate is ready to proceed with the launch of STS-109.

#### External Tank (ET)

The following four changes were presented: the qualification of the new flex hose liner, the increased liquid oxygen (LO2) tank dome cap membrane thickness, the revised liquid hydrogen (LH2) protuberance air load ramp angular build dimension, and the repair suspect LH2 line burst discs. There was one significant processing anomaly presented on the LO2 feedline foam concern. Flight rationale was presented. ET-112 is certified and ready for STS-109 flight pending completion/closure of open and planned work.

#### Reusable Solid Rocket Motor (RSRM)

One technical issue was presented on the O-ring resiliency reassessment. Recent O-ring resiliency test data indicates previous test/extrapolated resiliency may not be conservative which challenges the baseline design certification to the contract end item 2X tracking requirement for O-ring seals. There were three changes that were necessary to address the generic certification issue: (1) a waiver (one flight only) was generated to cover the generic design not meeting the STS-109 contract end item 2X tracking requirement at 80 °F, (2) an Launch Comment Criteria (LCC) change for STS-110 and subsequent to increase joint sensor temperature minimum to 86 °F and (3) a generic certification paperwork update to document new resiliency test data and new generic field joint LCC temperature. Flight rationale was presented for STS-109. Pending satisfactory completion of normal operations flow, the RSRM hardware is ready to support flight for mission STS-109.

### Solid Rocket Booster

One nonconformance on suspect corrosion beneath the rubber and paint on all Ethylene Propylene Diene Monomer covers was presented. A stock sweep has been performed on in-stock and flown covers. All the STS-109 covers have also been inspected in place; one cover was removed and replaced. Flight rationale was presented. There were three technical issues presented on the hydraulic pump bolt torque preload, the auxiliary power unit controller diode failure and the suspect connector. There are exceptions against the hydraulic pump and the connector to be addressed at the STS-109 Pre-Launch Mission Management Team (PMMT) Review. Flight rationale was presented for the auxiliary power unit controller diode failure. Pending successful resolution of the technical issues and completion of normal operations flow, there are no constraints to continue launch processing for STS-109.

### Space Shuttle Main Engine (SSME)

The SSME major components and engine performance were presented. This will be the first flight for the joint 01.1 seal redesign. This redesign replaced the silver coated "K" design with a Teflon "Omega" design. One special topic was presented on wear found on the main injector liquid oxygen post outer diameter surface. Flight rationale was presented; the STS-109 injectors have been inspected with no discrepancies found. The material review and problem report reassessment were also presented. All dispositions have been evaluated and judged acceptable for flight. The Main Engines are in ready condition for STS-109.

### Vehicle Engineering

The following four previous, STS-108, in-flight anomalies (IFA's) were presented on the reaction control system thruster R4U and F3F both failed off, the inertial measurement unit-2 Z-axis redundant anomaly and the flash evaporator system controller anomaly. All anomalies were reviewed and acceptable for STS-109 flight. The following STS-93 IFA's, previous OV-102 mission, were presented on the aft sidewall protection, landing gear down criticality 1/1 elimination, pyro harness heat-shrink, convoluted tubing through the clamps, 129 redundancy separations, monoball production break, redesign midbody crossover bracket, remove midbody wire tray risers, criticality 1R2 circuit redundancy improvement, auxiliary power unit heater criticality 1/1 elimination. One other IFA problem identified as the Alternating Current (AC)-1 Phase A short was also presented separately. All these anomalies and funnies have been reviewed and none are a constraint for the STS-109 flight.

There were two critical process changes presented on the titanium alloy tubing and the thermal protection system reusable surface insulation maintenance, tile installation (process 301). There were a total of 133 modifications incorporated during the OMDP/ STS-109 processing flow. The following four modifications are flying for the first time: device driver line replaceable unit replacement, the Xo576 bulkhead coldplate/coolant line removal, the sleep restraint upgrades, and the window #7 flight cover modification.

Six special topics were presented on the waste collection system check valve failure, the STS-108 postlanding drag chute ribbon damage, the pilot chute deployment bag damage, the hydraulic main pump mounting flange washers, the hydraulic main pump port cap bolts, and the investigation of the dedicated signal conditioner transistor failure. An exception was taken on the hydraulic main pump port cap bolts and will be addressed at the STS-109 PMMT. All the special topics, except for the hydraulic main pump port cap bolts, are acceptable for STS-109 flight.

One flight software topic presented was the unexpected general purpose computer synchronization failure. An exception has been taken pending successful resolution of STS-109 impacts/risks and the disposition of the discrepancy report. The exception will be addressed at the STS-109 PMMT review.

Pending completion of scheduled open work, the Orbiter Vehicle, Support Hardware, Flight Crew Equipment and Software are certified and ready to support STS-109.

#### Shuttle Processing

The processing differences, planned and unplanned, from the Vehicle Assemble Building and the Pad were presented. The integrated operations assessment summary was also presented. There was one unexplained anomaly presented on the mid AC1 Phase-A. While closing the payload bay doors at the pad, the midbody AC1 phase-A was not received at several latch/door drive motors. The most probable cause was determined to be a dirty contact. Flight rationale was presented.

There were two engineering topics presented. The first topic was the External Tank hydrogen umbilical retract anomaly. During the STS-108, Pad B, launch, the hydrogen vent arm contacted the fixed support service structure. The concern included potential debris impact with the vehicle and damage to the ground support equipment. An exception against this anomaly was recorded and will be addressed at the STS-109 PMMT review. The second topic was the Hazardous Gas Detection System (HGDS) 2000 which was presented for information only. The HGDS provides real-time gas analysis for the Orbiter, ET, and Hydrogen Umbilicals. The HGDS system certification and validation has been completed and is ready to support STS-109.

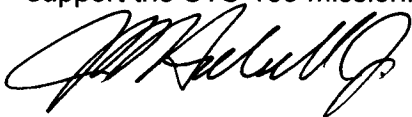
The STS-109 launch countdown summary, the turnaround options, and the landing operations status were presented. Pending completion of planned work and resolution of any identified constraints, KSC Shuttle Processing and supporting organizations are ready to support launch operations.

#### Safety & Mission Assurance (S&MA)

S&MA held reviews in preparation for the STS-109 FRR and is ready to proceed toward launch countdown. The only issue that has not already been mentioned above was the STS-108 Pad B handrail investigation which has been closed. With the satisfactory completion of identified open work, S&MA has no constraints to STS-109.

There were no action items assigned. The five exceptions will be closed with final flight rationale at the Prelaunch Mission Management Team meeting scheduled for February 26, 2002.

Mr. Gregory polled the principal managers and organizations. All responded ready to support the STS-109 mission.



James D. Halsell, Jr.  
Colonel, USAF  
Manager, Launch Integration

Enclosures:  
Agenda  
Exception Log

STS-109  
Flight Readiness Review  
February 14, 2002

Agenda

Introduction	Manager, Launch Integration
Mission Operations	Director, Mission Operations APM, Flight Operations, SFOC
EVA	Manager, EVA Project
Flight Crew	Director, Flight Crew Operations
Space and Life Sciences	Director, Space and Life Sciences
Program Integration	Mission Director Manager, Space Shuttle KSC Integration Manager, Space Shuttle Systems Integration Manager, Space Shuttle Customer and Flight Integration APM, Program Integration, SFOC
Payload Processing	Director of ISS/Payloads Processing
External Tank	Manager, External Tank Project
RSRM	Manager, Reusable Solid Rocket Motor Project
SRB	Manager, Solid Rocket Booster Project APM, SRB Element, SFOC
SSME	Manager, Space Shuttle Main Engine Project
Vehicle Engineering	Manager, Space Shuttle Vehicle Engineering APM, Orbiter Element, SFOC APM, Flight Software, SFOC APM, FCE/EVA, SFOC
Ferry Readiness	Ferry Operations Manager
Shuttle Processing	Director of Shuttle Processing APM, Ground Operations, SFOC APM, Integrated Logistics, SFOC
Range	United States Air Force
DDMS	Director, DDMS
Space Shuttle SR&QA	Manager, Safety, Reliability and Quality Assurance
Exception/Action Summaries	Manager, Launch Integration
Readiness Poll	Associate Administrator, Office of Space Flight

CoFR EXCEPTION LOG			CoFR REVIEW DATE: 02-14-02 STS FLT NO. STS-109
REQUIREMENT/ EXCEPTION NUMBER	ELEMENT	DESCRIPTION OF EXCEPTION	DUE DATE
109-FRR 001	SRB	<p>REQUIREMENT: NSTS 08117, SECTION 8.5.6.1.g (THERE ARE NO OPEN KEY ISSUES AFFECTING THE AS-DELIVERED ELEMENT)</p> <p>EXCEPTION: TWO SRB CABLES CONNECTORS FOUND WITH DEFECTIVE SOCKET FINGERS. INVESTIGATION UNDERWAY TO DETERMINE CAUSE, CORRECTIVE ACTION AND FLIGHT RATIONALE.</p>	STS-109 PMMT
109-FRR 002	SRB	<p>REQUIREMENT: NSTS 08117, SECTION 8.5.6.1.g (THERE ARE NO OPEN KEY ISSUES AFFECTING THE AS-DELIVERED ELEMENT)</p> <p>EXCEPTION: HYDRAULIC PORT CAP FASTENER ANALYSIS IS IN QUESTION. INVESTIGATION UNDERWAY TO DETERMINE CAUSE, CORRECTIVE ACTION AND FLIGHT RATIONALE.</p>	STS-109 PMMT
109-FRR 003	ORBITER	<p>REQUIREMENT: NSTS 08117, SECTION 8.5.1.1 d. "NECESSARY SAFETY ANALYSIS, MATERIALS TESTS, AND CERTIFICATION AND FLIGHT READINESS REQUIREMENTS ARE COMPLETED".</p> <p>EXCEPTION: A 1.4 FACTOR OF SAFETY CANNOT BE DEMONSTRATED FOR THE HYDRAULIC PUMP PORT CAP BOLTS. MORE TESTING AND ANALYSIS IS REQUIRED TO DEMONSTRATE AN ACCEPTABLE FACTOR OF SAFETY FOR THE CURRENT OUT-OF-PRINT CONDITION.</p>	STS-109 PMMT

# CoFR EXCEPTION LOG

CoFR REVIEW DATE: 02-14-02 STS FLT NO. STS-109			
REQUIREMENT/ EXCEPTION NUMBER	ELEMENT	DESCRIPTION OF EXCEPTION	DUE DATE
109-FRR 004	FLIGHT SOFTWARE	NSTS 08117, SECTION 8.5.18.1.a - SFOC UNIQUE RESPONSIBILITIES - ALL ANOMALIES THAT POTENTIALLY IMPACT PROCESSING, LAUNCH, MISSION SUCCESS, OR LANDING HAVE BEEN REPORTED AND SUCCESSFULLY RESOLVED WITH NASA. ANALYSIS OF POTENTIAL IMPACTS OF FLIGHT SOFTWARE DISCREPANCY REPORT (DR) 110884 - GPC 3 FAIL-TO-SYNC (FTS) FOLLOWING INDUCED FTS OF GPC 2 - IS IN WORK. THE DR WAS SUBMITTED ON 02-04-02 IN RESPONSE TO AN UNEXPECTED FTS SCENARIO IN THE SHUTTLE MISSION SIMULATOR ON STS-110 (OI-29). WHILE THE SPECIFIC SIGNATURE OBSERVED IS NOT POSSIBLE ON STS-109 (OI-28), ANALYSIS OF OTHER POTENTIAL EFFECTS IS REQUIRED TO DETERMINE DISPOSITION OF THIS DR FOR FLIGHT. COMPLETION TO BE REPORTED AT L-2.	STS-109 PMMT
109-FRR 005	GROUND OPERATIONS	NSTS 08117, SECTION 8.5.8.1 PARAGRAPH A PAD A ET VENT ARM IS NOT READY TO SUPPORT LAUNCH	STS-109 PMMT